

REMARKS

The Examiner's Rejections

The Examiner rejected claims 1-12 under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 7,391,715 to Lee et al. (hereinafter "Lee") in view of U.S. Patent Publication No. 2004/0071118 to Dabak (hereinafter "Dabak") and Applicants' disclosure of prior art.

The Disclosure of Lee

Lee relates to a transmitter device and transmitting method using OFDM and MC-CDMA. Fig. 2B of Lee discloses a receiver device 2 having an antenna 21, a division multiple receive unit 22, a de-mapping unit 23 and a decoding de-interleaving unit 24.

The Disclosure of Dabak

Dabak relates to a system and method for receiving a multi-carrier UWB transmission with reduced power consumption and computational requirements. Fig. 4 of Dabak illustrates a digital section 420 of an UWB receiver 400 including an analog-to-digital converter (ADC) 422, a remove cyclic prefix unit 424, a despreader 426, a Fourier transform unit 428, an error correction decode unit 430, and a DC estimator 432.

Independent Claims 1 and 7 are Patentable Over the Combination of Lee, Dabak and Applicants' Disclosure of Prior Art

Applicants respectfully traverse the Examiner's rejection of independent claims 1 and 7 in view of the combination of Lee, Dabak and Applicants' disclosure of prior art. The combination suggested by the Examiner would render a reference inoperable for its intended purpose

In the Official Action, the Examiner acknowledged that Lee does not disclose a despreader placed prior to the orthogonal transform block, an equalizer or that the deinterleaver is prior to the parallel to serial converter. See Sections 4 and 5 on pages 2 and 3 of the Official Action. The Examiner relies upon Dabak and Fig. 1(b) of the present application to reject claims 1 and 7 as being obvious over the combination of Lee, Dabak and Fig. 1(b). Specifically, the examiner asserted that it would have been obvious to one of ordinary skill in the art to include the teachings of Dabak in the receiver of Lee to reverse the despreading and FFT operations.

Applicants respectfully disagree and submit that the positions of despreader and FFT module of Lee cannot be reversed as suggested by the Examiner. To elaborate, in the following paragraphs, Applicants provide an example to illustrate why it is technically not possible to

exchange the positions of the despreader 224 and the FFT 223 in Lee's receiver. As explained in the Abstract, and as shown in Figure 2B, let's take the example of the receiver of Lee working in MC-CDMA mode as there is no spreading/despreading operation in OFDM mode. For simplicity and without loss of generality, let's assume the parameters N_c (size of IFFT) = SF (spreading factor) so that there is only one Copier Section 152, Fig. 2A in the receiver.

At the transmitter, a signal symbol S_1 is first copied as $S_{1,1}, S_{1,2} \dots S_{1,N_c}$ by a copier section 152 and then the symbols are multiplied by a spreading code $C_{1,1}, C_{1,2} \dots C_{1,N_c}$ in a spreading section 153 and become $S_{1,1}C_{1,1}, S_{1,2} C_{1,2} \dots S_{1,N_c} C_{1,N_c}$. After IFFT, the signal written in a matrix form becomes:

$$\begin{bmatrix} R_{1,1} \\ \vdots \\ R_{1,N_c} \end{bmatrix} = F^H \begin{bmatrix} S_{1,1} \cdot C_{1,1} \\ \vdots \\ S_{1,N_c} C_{1,N_c} \end{bmatrix} \quad (1)$$

where F^H stands for the IFFT matrix with Hermitian sign "^H". At the receiver, if the FFT is performed before the despreading as in Fig. 2B, the signal after FFT 223 will be (ignoring noise and interference):

$$F \begin{bmatrix} R_{1,1} \\ \vdots \\ R_{1,N_c} \end{bmatrix} = F F^H \begin{bmatrix} S_{1,1} \cdot C_{1,1} \\ \vdots \\ S_{1,N_c} C_{1,N_c} \end{bmatrix} = \begin{bmatrix} S_{1,1} \cdot C_{1,1} \\ \vdots \\ S_{1,N_c} C_{1,N_c} \end{bmatrix} = \begin{bmatrix} C_{1,1} \\ \vdots \\ C_{1,N_c} \end{bmatrix} S_1 \quad (2)$$

To proceed with the despreading at the despreader 224, the signal can be recovered as:

$$\begin{bmatrix} C_{1,1} & \dots & C_{1,N_c} \end{bmatrix} \begin{bmatrix} C_{1,1} \\ \vdots \\ C_{1,N_c} \end{bmatrix} S_1 = S_1 \quad (3)$$

Note that in the above equations $S_1 = S_{1,1} = S_{1,2} = \dots = S_{1,N_c}$ and $C_{1,1}C_{1,1} + \dots + C_{1,N_c} C_{1,N_c} = 1$.

However, if the order of the FFT and despreading is reversed as asserted by the Examiner in view of the teachings of Dabak, i.e., applying despreading 224 first followed by FFT 223, the signal cannot be recovered. In fact, despreading the signal (1) would yield

$$\begin{bmatrix} C_{1,1} & \dots & C_{1,N_c} \end{bmatrix} F^H \begin{bmatrix} S_{1,1} \cdot C_{1,1} \\ \vdots \\ S_{1,N_c} C_{1,N_c} \end{bmatrix} = \left(\begin{bmatrix} C_{1,1} & \dots & C_{1,N_c} \end{bmatrix} F^H \begin{bmatrix} C_{1,1} \\ \vdots \\ C_{1,N_c} \end{bmatrix} \right) S_1 \quad (4)$$

It is noted that the term in the round bracket in (4) is a complex number (not equal to 1) in general. It does not make sense to apply FFT 223, which takes in a vector as its input in the example, on the signal (4) after despreading. As a result, swapping the positions of the despreader 224 and the FFT 224 would render the receiver of Lee inoperable. Therefore, Applicants submit that it would not have been obvious to combine the documents as asserted by the Examiner.

Claim 7 of this application is a method equivalent of claim 1, and thus, the above comments also apply to this claim. For at least these reasons, Applicants submit that independent claims 1 and 7 patentably define the invention over the combination of Lee, Dabak and Applicants' disclosure of prior art. Claims 2-6 and 8-12 are dependent directly or indirectly from claim 1 or claim 7 and thus are also patentable at least for this reason.

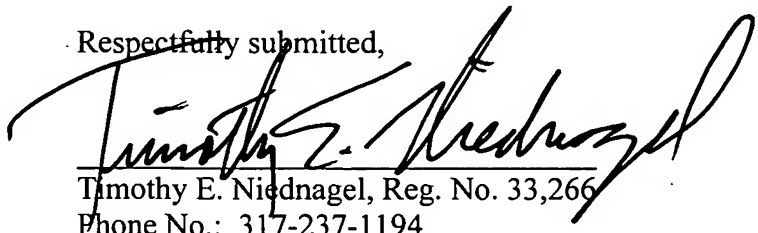
Therefore, Applicants submit that claims 1-12 are in condition for allowance. Such action is respectfully requested.

SUMMARY AND CONCLUSION

Applicants have made a sincere effort to place the present application in condition for allowance and believe that they have done so. Applicants have pointed out significant and substantial shortcomings of the documents relied upon by the Examiner with respect to the pending claims. Applicants have further discussed the explicitly recited features of Applicants' claims and have noted the shortcomings of the relied upon documents with respect thereto. Accordingly, Applicants have provided a clear evidentiary basis supporting the patentability of all the claims in the present application and respectfully request a prompt passage to issuance.

Any amendments to the claims which have been made in this amendment, and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed to attach thereto. Should the Examiner have any questions or comments regarding this Response, or the present application, the Examiner is invited to contact the Applicants' undersigned attorney at the telephone number set out below.

Respectfully submitted,



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